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The Impact of the European Union-South Africa Free Trade Area Agreement on Factor Returns in South Africa: Much Ado About Nothing?

By

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Declaration

I would like to declare that this thesis is my own original work, produced by my own efforts apart from the assistance received from my supervisor. All sources of information have been fully credited and acknowledged.

I also declare that this thesis has not been and will not be presented to any other university for any other degree.

Signed by candidate

29/03/2007

J. Thabo Chauke Date

This research paper has been submitted for examination with my approval as the university supervisor.

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Dr. Lawrence Edwards Date

LIST OF CONTENTS

TABLES

FIGURES

ABBREVIATIONS

ACP	African, Caribbean and Pacific Group of States
DTI	Department of Trade and Industry
EU	European Union
FTA	Free Trade Area
GATT	General Agreement on Tariffs and Trade
GEAR	Growth, Employment and Redistribution
GEIS	General Export Investment Scheme
GSP	Generalized System of Preferences
IMS	Integrated Manufacturing Strategy
MFN	Most Favoured Nation
RDP	Reconstruction and Development Programme
RIDP	Regional Industrial Development Programme
SACU	Southern African Customs Union
SADC	Southern African Development Community
SIC	Standard Industrial Classification
StatSA	Statistics South Africa
TDCA	Trade, Development and Co-operation Agreement
TIPS	Trade and Industrial Policy Secretariat
TPR	Trade Policy Review
UNCTAD	United Nations Conference on Trade and Development
WTO	World Trade Organization

1. INTRODUCTION

The notion that the returns of unskilled labour in developed countries are adversely affected by growth in trade with developing countries as a result of trade liberalisation has received a great deal of attention. What underpins this notion is the standard trade theory which posits that trade is determined by factor endowments; hence, trade liberalisation will benefit the relatively abundant factors of production. Since developed countries are relatively abundant in capital and skilled labour, the theory predicts that capital and skilled labour will benefit from trade liberalisation whilst the returns of the scarce factor, unskilled labour, would decline in relative terms. This will increase inequality in the returns of capital and labour or skilled- and unskilled-workers in developed countries. The converse will prevail in developing countries where trade liberalisation stands to reduce wage inequality. What becomes germane to the discussions is that trade liberalisation gives rise to winners and losers. Thus for trade liberalisation to be of mutual benefit, winners must compensate losers for their loss.

The thrust of the economic policy of South Africa is outward-orientation despite the country having one of the most unequal income distributions in the world (RDP, 1994 and GEAR, 1996). The Global Economic Strategy of South Africa asserts, *"South Africa's interests, and those of other developing countries, coalesce around market access and economic development*" (Ismail et al, 2001:11). Increasing market access for South African products is imperative considering that the country has a relatively small and underdeveloped market with a skewed income distribution (TPR: South Africa, 1998). To this end, the advent of the European Union-South Africa Trade, Development and Co-operation Agreement (hereafter TDCA) in January 2000 was expected, among other things, to buttress the ongoing economic restructuring in South Africa by providing better market access for South African products (Erwin, 2000). It was further expected that the TDCA would induce South Africa to specialize more in export production and thereby stimulate exports to this vast market. Thus it would augur well for the country if income gains from trade could accrue to unskilled workers in line with the predictions of trade theory. Against this background, this paper seeks to assess and empirically determine the impact of the TDCA on the South African la-

bour market. In particular, the paper aims to assess the impact of tariff reduction in response to the TDCA on (a) the demand for labour and (b) factor returns. In doing so, two methodologies will be adopted, namely: the factor content and the price approach.

There are several reasons why South Africa provides a good case study for investigating the effects of the TDCA on the labour market. First, high unemployment, especially among unskilled labour, is a serious problem in South Africa and the country has one of the most unequal income distributions in the world. In an effort to redress unemployment and income inequality in South Africa, the new government promulgated a myriad of policies, which must be assessed in regard to how policies such as trade liberalisation affect attainment of policy objectives. Insight into the effect of the TDCA will provide guidance to government as it negotiates other free trade agreements. Second, tariff reductions under the TDCA cover a wide spectrum of sectors. Third, the developing country experience can provide independent support for or against the view that increasing trade between developed and developing countries is inimical to the interests of unskilled workers in the developed countries (Fedderke et al, 1999). Evidence that trade liberalisation reduces wage inequality in developing countries provides support for the mechanisms through which trade affects labour.

This paper will extend the analysis of existing studies on South Africa in a number of important directions. First, it studies the role of preferential trade between two trading countries as theory suggests rather than between South Africa with all of its trading partners together. This is imperative in light of the variation in the pattern of South Africa's trade across its trading partners (Alleyne and Subramaniam, 2001). As a middle-income country, South Africa possesses characteristics of both developed and developing countries. The impact of trade on factors of production may therefore be ambiguous. Second, this paper also addresses the problem associated with calculating prices accurately by using the proposed tariffs between 2000 and 2012 as a proxy for product-price change. This is important considering the following seminal inputs of Slaughter (1998 (a): 2) "*...more work needs to link the various exogenous forces attributable to international trade to actual product- price changes*".

The paper is structured as follows. Section 2 provides an overview of the European Union-South Africa Trade, Development and Co-operation Agreement. Section 3 outlines the theory underlying the research, and analyses the results of international studies and studies done in South Africa. Section 4 presents an overview of the empirical methodology, data and results; section 5 concludes.

2. AN OVERVIEW OF THE EUROPEAN UNION-SOUTH AFRICA TRADE, DEVELOPMENT AND CO-OPERATION AGREEMENT (TDCA)

After the new government was installed in 1994, South Africa applied for Lomé IV Convention membership, which was considered as a comprehensive offer by the European Union to the African, Caribbean and Pacific (ACP) countries (Davies, 2000). The Lomé Convention covered political dialogue, aid allocation and instruments, and non-reciprocal trade preferences to exports of ACP countries. Many products from these countries were given access into the EU market, although most agricultural products were excluded since they were considered to be a 'sensitive' sector by the EU (Solignac-Lecomte, 2000). Four commodity protocols governed the trade of bananas, rum, sugar and beef and these products were accorded free but limited market access into the EU. Against this background, the new South African government felt that the non-reciprocal preferences extended to the ACP countries was a better platform to trade with the EU. Since all the then Southern African Development Community (SADC) countries were members of the Lomé Convention, it was seen as lending support to efforts by South Africa to promote regional integration (Davies, 2000).

In response, the EU conferred on South Africa a partial accession to the Lomé Convention in 1997. Full accession was not granted for two reasons. First, South Africa is not considered by the WTO to be a developing country, a position the EU aligned itself with fully. Second, the Lomé Convention was set to expire in February 2000 and the EU was not keen to continue it in its existing structure. Although South Africa was excluded from the trade chapter of the Lomé Convention, it is important to note that the country was already granted the generalized system of preferences (GSP) status by the EU in 1994 although the terms and conditions were different from that of the Lomé Convention (Links, 2000). By 1995, about 75% of South African exports entered the EU market free of tariffs

(Lowe, 2000). South Africa's membership under the Lomé Convention was limited to co-operation and the country was allowed, for purposes of meeting rules of origin, to 'cumulate' diagonally with other ACP countries. This means that inputs sourced from other ACP countries are considered to have originated in South Africa provided the value added in this country exceeds the value of the inputs procured from the ACP countries.

Instead of granting South Africa full Lomé Convention benefits, the EU indicated that it wanted to negotiate a free trade area (FTA) with South Africa and negotiations began in June 1995. The FTA negotiations were predicated upon the following twin concepts: asymmetry and differentiation. These concepts were meant to address disparate development levels of the two negotiating parties. Asymmetry and differentiation found expression in terms of timing, scope and coverage respectively. In line with the principle of asymmetry and differentiation, the EU and South Africa would liberalise their products over a period of 10 and 12 years respectively. In addition, the EU would dismantle tariffs in most of its products within the first three years upon the implementation of the agreement, while South Africa would liberalise the first basket of its products in 2006. In terms of scope and coverage, the EU would liberalise about 95% of South African exports while the figure for South Africa would be 86%.

For the first time the EU agreed to include agricultural products in an FTA. In addition, the parties agreed to use the negative list approach in constructing their market access offers. The negative list approach allowed the parties to indicate the products in which they would want to make concessions. This was important in helping to address sensitive sectors. To mitigate undesirable effects on the economies of other Southern African Customs Union (SACU) member states, the EU-SA TDCA made provision for a safeguard clause; exclusion of sensitive products such as beef and sugar by South Africa; full cumulation of origin within SACU; and, granting special assistance if deemed necessary (Lowe, 2000). In addition, the agreement allows South Africa to restrict entry of some manufactured goods including motor vehicles and some textiles. Furthermore the agreement permits each party to implement 'appropriate measures' unilaterally if the other party violates principles of democracy, human rights, and the rule of law.

The EU-SA TDCA covered not only trade in goods and services but included other trade-related areas such as competition policy, intellectual property, government procurement. The FTA satisfied the requirements of the WTO (Article XXIV of the GATT of 1994) by covering 'substantially all trade', that is about 90% of the traded sectors were included. The EU-SA TDCA was implemented in January 2000 and the process is expected to be completed in 2012.

***Table 1:* Tariff Elimination Schedule of South Africa and the EU**

	South Africa			EU		
Supply-use table	2000 (1)	2012 (2)	%price Δ* (3)	2000 (4)	2012 (5)	% price Δ$ (6)
1. Agricultural products	4.932	1.511	**3.26**	9.7	5.8	**4.0**
2. Coal and lignite products	0.000	0.000	**0.00**	0.0	0.0	**0.0**
3. Gold and uranium ore products	0.000	0.000	**0.00**	0.0	0.0	**0.0**
4. Other mining products	0.255	0.000	**0.25**	0.0	0.0	**0.0**
5. Meat products	17.080	14.885	**1.88**	19.2	11.1	**8.1**
6. Fish products	19.155	19.155	**0.00**	11.8	11.8	**0.0**
7. Fruit and vegetables products	17.529	1.294	**13.81**	23.1	8.3	**14.7**
8. Oils and fats products	4.698	1.458	**3.09**	4.9	0.6	**4.3**
9. Dairy products	16.824	16.824	**0.00**	7.8	4.5	**3.3**
10. Grain mill products	8.272	3.370	**4.53**	13.1	11.5	**1.6**
11. Animal feeds	4.000	0.000	**3.85**	1.5	0.0	**1.5**
12. Bakery products	21.063	0.000	**17.40**	24.0	24.0	**0.0**
13. Sugar products	0.000	0.000	**0.00**	27.4	26.6	**0.7**
14. Confectionary products	16.158	4.842	**9.74**	22.4	18.8	**3.7**
15. Other food products	14.847	0.408	**12.57**	11.7	9.2	**2.4**
16. Beverages and tobacco products	22.235	7.441	**12.10**	6.3	2.4	**4.0**
17. Textile products	20.693	9.532	**9.25**	6.7	0.0	**6.7**
18. Made-up textile products	29.273	10.104	**14.83**	8.6	0.0	**8.6**
19. Carpets	30.000	15.000	**11.54**	7.6	0.0	**7.6**
20. Other textile products	14.885	6.048	**7.69**	6.0	0.0	**6.0**
21. Knitting mill products	23.357	10.561	**10.37**	9.2	0.0	**9.2**
22. Wearing apparel	36.727	17.427	**14.12**	9.1	0.0	**9.1**
23. Leather products	4.348	0.000	**4.17**	2.0	0.0	**2.0**
24. Handbags	25.000	15.882	**7.29**	0.0	0.0	**0.0**
25. Footwear	23.468	10.806	**10.25**	8.1	0.0	**8.1**
26. Wood products	8.933	1.333	**6.98**	1.3	0.0	**1.3**
27. Paper products	5.905	0.238	**5.35**	0.0	0.0	**0.0**
28. Containers of paper	10.714	0.000	**9.68**	0.0	0.0	**0.0**
29. Other paper products	8.929	0.714	**7.54**	0.6	0.0	**0.6**
30. Published and printed products	5.909	0.000	**5.58**	1.0	0.0	**1.0**
31. Recorded media products	0.909	0.909	**0.00**	1.7	0.0	**1.7**
32. Petroleum products	4.730	1.959	**2.65**	0.2	0.0	**0.2**
33. Basic chemical prod-	1.637	0.222	**1.39**	2.1	0.3	**1.8**

Supply-use table	South Africa 2000 (1)	South Africa 2012 (2)	%price Δ* (3)	EU 2000 (4)	EU 2012 (5)	% price Δ$ (6)
ucts						
34. Fertilizers	0.000	0.000	**0.00**	3.3	0.0	**3.3**
35. Primary plastic products	4.713	0.846	**3.69**	3.7	0.0	**3.7**
36. Pesticides	6.667	0.000	**6.25**	1.7	0.0	**1.7**
37. Paints	4.091	0.455	**3.49**	0.2	0.0	**0.2**
38. Pharmaceutical products	1.140	0.187	**0.94**	0.2	0.0	**0.2**
39. Soap products	15.667	9.111	**5.67**	0.1	0.1	**0.0**
40. Other chemical products	4.185	0.643	**3.40**	1.9	1.5	**0.4**
41. Rubber tyres	18.121	17.086	**0.88**	1.4	0.0	**1.4**
42. Other rubber products	10.104	2.179	**7.20**	0.2	0.0	**0.2**
43. Plastic products	12.010	0.576	**10.21**	1.9	0.0	**1.9**
44. Glass products	6.733	1.553	**4.85**	2.0	0.0	**2.0**
45. Ceramic ware	11.333	0.000	**10.18**	2.4	0.0	**2.4**
46. Ceramic products	4.444	0.000	**4.26**	2.2	0.0	**2.2**
47. Cement	0.000	0.000	**0.00**	0.0	0.0	**0.0**
48. Other non-metallic products	4.857	0.214	**4.43**	0.0	0.0	**0.0**
49. Iron and steel products	4.366	0.309	**3.89**	1.9	0.0	**1.9**
50. Non-ferrous metals	2.567	0.227	**2.28**	2.4	0.2	**2.2**
51. Structural metal products	4.167	0.000	**4.00**	1.9	0.0	**1.9**
52. General hardware products	10.508	1.452	**8.20**	0.0	0.0	**0.0**
53. Other fabricated metal products	6.677	1.796	**4.57**	2.7	0.0	**2.7**
54. Engines	3.870	0.739	**3.01**	0.6	0.0	**0.6**
55. Pumps	6.000	0.000	**5.66**	0.4	0.0	**0.4**
56. Gears	9.432	0.000	**8.62**	0.4	0.0	**0.4**
57. Lifting equipment	4.083	0.400	**3.54**	0.6	0.0	**0.6**
58. General machinery	3.191	0.730	**2.38**	0.0	0.0	**0.0**
59. Agricultural machinery	2.242	0.152	**2.05**	0.0	0.0	**0.0**
60. Machine-tools	1.673	0.000	**1.65**	0.0	0.0	**0.0**
61. Mining machinery	0.571	0.286	**0.28**	0.2	0.0	**0.2**
62. Food machinery	0.000	0.000	**0.00**	0.0	0.0	**0.0**
63. Other special machinery	3.212	0.000	**3.11**	0.5	0.0	**0.5**
64. Household appliances	13.652	1.667	**10.55**	1.3	0.0	**1.3**
65. Office machinery	0.000	0.000	**0.00**	0.5	0.0	**0.5**
66. Electric motors	4.513	0.000	**4.32**	0.0	0.0	**0.0**
67. Electricity apparatus	6.033	0.683	**5.05**	0.0	0.0	**0.0**
68. Wire and cable products	13.900	2.200	**10.27**	3.9	0.0	**3.9**
69. Accumulators	3.774	0.000	**3.64**	0.0	0.0	**0.0**
70. Lighting equipment	11.636	2.841	**7.88**	1.9	0.0	**1.9**
71. Other electrical products	3.000	0.000	**2.91**	0.2	0.0	**0.2**
72. Radio and television products	3.395	1.042	**2.28**	2.5	0.0	**2.5**
73. Optical instruments	0.363	0.093	**0.27**	0.3	0.0	**0.3**
74. Motor vehicles	19.507	6.015	**11.29**	6.8	0.3	**6.5**
75. Motor vehicles parts	14.438	12.521	**1.67**	2.4	2.4	**0.0**
76. Other transport products	1.561	0.250	**1.29**	0.7	0.0	**0.7**
77. Furniture	18.333	7.500	**9.15**	1.0	0.0	**1.0**

	South Africa			EU		
Supply-use table	2000 (1)	2012 (2)	%price Δ* (3)	2000 (4)	2012 (5)	% price Δ$ (6)
78. Jewellery	7.500	0.000	**6.98**	0.3	0.0	**0.3**
79. Other manufacturing	6.024	1.718	**4.06**	1.0	0.4	**0.7**
Unweighted average %price Δ			**5.21%**	Unweighted average %price Δ		**2.06**
[1]where %Price Δ= ((1 + t_f/100)/ (1 + t_i/100))-1				$ where %PriceΔ=(t_f - t_i)		

Source: Statistics South Africa (???)

Table 1 presents the tariff offers of South Africa and the EU. As indicated in the introduction, this paper uses the proposed tariffs between 2000 and 2012 as a proxy for product-price change. The Standard Industrial Classification, that is SIC 4-digits, data were used and it was derived from the Supply-Use table of Statistics South Africa. Since this data is going to be used in the Product Price-approach, it is instructive to note that the results from previous studies were robust despite data aggregation (Slaughter, 1998). "*Many studies of the manufacturing sector use four-digit SIC industries (Leamer, Krueger, FH). Studies using three-digit data (LS, SS, BC) and/or two- digit data (LS, BC) obtain qualitatively similar results to the more disaggregated studies*" (Slaughter, 1998(a): 31).

The values in Table 1 reflect the simple average tariff rate by sector calculated using disaggregated HS-8 digit data. Using simple average tariff rate is in keeping with SS theorem treats all industries equally (Slaughter, 1998). "*A product-price change in even the smallest industry is qualitatively just as important as a product price in the largest industry. This suggests that any data analysis should weight all industries equally*" (Slaughter, 1998(a): 30). Columns 3 and 6 present the expected change in price arising from the TDCA. Using tariff reductions of 10% or more to represent significant tariff reductions, Table 1 demonstrates that a meaningful cut in tariffs will be made in the following few South African sectors: bakery products (17%), made-up textiles (15%), wearing apparel (14%), fruit & vegetables (14%), other food products(13%), carpets(11%), motor vehicles (11%), knitting mill products (10%), ceramic (10%), wire and cable products

[1] The reason why two different formulae are used in calculating unweighted average change in price is to illustrate the fact that South Africa is considered small hence changes in its tariffs would not affect world prices. By contrast, the EU is large hence changes in its tariffs would affect world prices.

(10%), plastic products (10%); and, footwear (10%). High tariffs were imposed on these products ranging between 11 to 37% at the time of the implementation of the TDCA. Important to note is the presence of the clothing and textiles sector, which is often a significant employer of unskilled labour in most developing countries (see Annexure B: Capital-Labour ratio). In the case of the EU, only fruit and vegetables products will face tariff reduction of 15%. While many products have zero tariffs, those that still enjoy high tariffs were either excluded or their tariffs were reduced marginally.

In one of the earliest studies to be done on the impact of TDCA, Jachia and Teljeur (1998) find that the agreement will benefit EU exports more than South African exports. Their results were partly determined by the patterns of import tariffs, trade flows, and the structure of the proposals of South Africa and the EU. From their results, it emerged that the EU's tariff reductions were relatively smaller when compared with that of South Africa; hence, their contention that the TDCA stands to create trade for the EU.

3. THEORY UNDERPINNING THE IMPACT OF TRADE ON LABOUR

3.1. HECKSCHER-OHLIN THEORY AND THE STOLPER-SAMUELSON THEOREM

This paper draws on the theory of Heckscher-Ohlin (hereafter H-O) to explain the impact of trade on labour. The H-O theory states that, with identical technologies and preferences across countries, a country will export products that intensively use the abundant factor and conversely import products that intensively use the scarce factor. Trade is determined entirely by differences in relative factor endowments. A corollary of this theory is that a country will protect products that intensively use a scarce factor. Therefore trade between developing and developed countries respectively will result in the former exporting unskilled labour intensive products and in turn importing skilled labour intensive products from the latter.

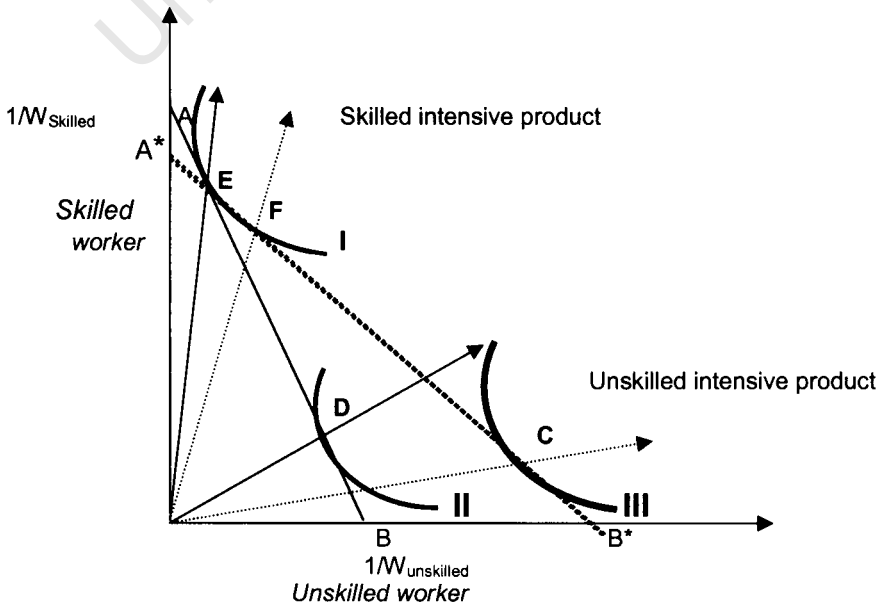
In addition to the H-O theory, the paper uses the following theorem: Stolper-Samuelson (hereafter SS), to link the effects of trade to the factor market. The SS theorem states that *"an increase in the price of the labour intensive product*

causes an increase in the real-wage rate and a reduction in the real return to capital" (Leamer, 1995: 7). Employing the assumption of perfect competition in all markets, this suggests that open trade will reduce the real wages of the scarce factor and increase that of the abundant factor. What is important to note is the fact that the SS theorem is silent on what happens to either trade flows or employment, however, if factor rigidity exists, then this will necessitate changes in relative factor demand. The next section shows how trade between developed and developing countries is expected to profit skilled labour in the former and unskilled labour in the latter.

3.2. APPLICATION OF THE LEARNER-PEARCE DIAGRAM

This section hinges heavily on the work of Leamer (1995) and Wood (1997).The 2x2x2 Heckscher-Ohlin-Samuelson model is used to analyse the impact of trade on the labour market. The model assumes a two-sector, two- factor and two-country framework. Figure 1 shows two trading partners (South Africa and the EU) both using two factors of production (skilled- and unskilled- workers) to produce two products (skilled intensive product and unskilled intensive product). The model assumes full employment; inter sectoral mobility of factors but internationally immobile; constant returns to scale; identical and homothetic preferences; and, both competitive factor and product markets.

Figure 1*:* Graphic Representation of the Effects of the Stolper-Samuelson Theorem



South Africa is considered to be a small country and abundantly endowed with unskilled-workers. By contrast the EU is abundantly endowed with skilled-workers. The implication is that the former will have a comparative advantage in the production of unskilled intensive product and the latter in skilled intensive product. The barriers to trade inhibit trade of these respective products between South Africa and the EU resulting in the prices of unskilled intensive product in South Africa being cheaper relative to in the EU. Similarly, the price of skilled intensive product is cheaper in the EU relative to in South Africa.

3.2.1. The effects of liberalisation on factors

In Figure 1, the unit-value isoquants for the skilled intensive product and the unskilled intensive product show the minimum combinations of skilled- and unskilled-workers required to produce each of those products respectively (i.e. curves marked I, II, and III). The tangency of the unit-value isoquants for the two goods at points E and D to the unit-isocost line (represented by the solid line connecting the points, $1/W_{skilled}$ and $1/W_{unskilled}$,) is the only unit-isocost line compatible with the production of the goods given the zero profit condition. Any other isocost line would either leave unexploited profit opportunities or would force a sector out of existence because of negative profits. Thus the equation for this isocost line is $R1 = SW_{skilled} + USW_{unskilled}$, where S and US represent the amount of skilled and unskilled workers that are employed and $W_{skilled}$ and $W_{unskilled}$ are the corresponding factor returns of these inputs. Therefore the slope of the isocost line is the relative wage of unskilled workers to skilled workers.

In Figure 1, the dotted line illustrates the unit-isocost line connecting A* and B* points. This line shows that trade liberalisation culminated in the reduction in the slope and consequently the unitary isoquant of unskilled intensive product shifted outward from II to III. Therefore, the volume of production of unskilled intensive product has to increase to yield a unit value of output. By assuming that the technological improvement is Hicks-neutral, the new unit-value isoquant will be established. The new unit-value isoquant is parallel to the initial isoquant II thus implying that the ratio of skilled to unskilled workers at the original wage ratio remains unchanged. Hence, the new wage equilibrium ratio ($W_{skilled}/W_{unskilled}$) will

settle at point C in the diagram. Consequently, improvement in productivity in the production of unskilled intensive product will result in a reduction of production costs and profitability at fixed product prices and initial factor prices. This will induce producers of skilled intensive product to move production resources away from the skilled intensive product to unskilled intensive product. Since production of skilled intensive product is skilled intensive, more skilled workers are released from this sector than is required in the production of unskilled intensive product. This will put downward pressure on the wages of skilled workers. By contrast, not enough unskilled workers will be released by the shrinking production of skilled intensive product than is required by the unskilled intensive sector, which means that wages of unskilled workers will have to increase. Consequently, the wages of unskilled- and skilled-workers will increase and decrease, respectively. This is shown by the slope of the new isocost line which is less than that of the old line hence wage inequality has decreased. Since the unskilled-skilled labour intensity of production increased in both sectors, firms will have an incentive to substitute the expensive factor in the production of both products by the cheaper one as long as Leontieff production is not assumed. The above exposition explains the situation in the South Africa given the assumption that it is abundantly endowed with unskilled workers.

Thus a tariff reduction will lead to expansion of trade and would raise the price of the unskilled intensive product and lower the price of the skilled intensive product respectively in South Africa, whilst the opposite will prevail in the EU. Such derived changes in product prices in accordance with the Stolper-Samuelson theorem would increase the wages of unskilled workers relative to that of skilled workers in South Africa. Similarly, an increase in the price of skilled intensive product in the EU would raise the wages of skilled workers relative to that of unskilled workers. These results stem from the assumption of fixed technology in these countries, which in turn implies a fixed relationship between the prices of products and the wages of factors.

Shortcomings of the Stolper-Samuelson theorem include prospects for exaggerating the impact of factor returns from changes in product prices. For instance, if in South Africa a decrease in price occurs in unskilled labour intensive products

that are non-traded, these will not be translated into a decrease in wages of unskilled labour relative to skilled labour. In fact, the opposite might occur given that prices will have declined and wages of unskilled labour would have remained unchanged. Moreover it is possible that an unskilled labour abundant country could resort to capital-intensive production as a way to stave off competition from unskilled labour abundant countries. This is the 'defensive innovation' argument advanced by Wood (1995).

3.3. INTERNATIONAL STUDIES

Lawrence and Slaughter (1993) assess the Stolper-Samuelson theorem by scrutinising the relative product prices. They find almost no evidence to support the notion that trade explains wage differentials since the 1970s considering growth in labour productivity. Using aggregate time-series data, they find that between 1979 and 1991, slow productivity growth in the US non-traded goods sectors explained the stagnation of real wages. They contend that for trade to be the underlying factor, the relative price of goods produced with labour intensive methods should have decreased. By contrast, they find that the relative price of goods produced with labour intensive methods slightly increased during the 1980s. The U.S. manufacturing shift towards the intensive use of non-production workers (i.e. skilled workers) despite a rise in their wages strengthened the argument that change in technology was a factor explaining the declining wages of production workers (i.e. unskilled workers).

The results obtained by Lawrence and Slaughter (1993) were criticised by Sachs and Shatz (1994) owing to the inclusion of computer prices in the sample. They argue that computer prices declined by a huge amount during the decade suggesting that the prices matched extraordinary productivity increases. This being the case, the productivity improvement implies that their effective prices also dropped by a large amount. In their study on trade between the U.S. and developing countries over 15 years, Sachs and Shatz (1994) find that U.S. trade with developing countries was increasing. In keeping with the prediction of the HOS model, the U.S. was exporting skill intensive products and importing less skill intensive products. Net imports were accompanied by a significant shedding of production jobs in manufacturing relative to non-production jobs. In particular,

they find that between 1978 and 1990, production manufacturing jobs, which are comprised mainly of unskilled workers, and production manufacturing jobs, which are comprised mainly of skilled workers, lost 7.2% and 2.1% workers respectively. As they aptly put it "*...one sees a situation of job losses in manufacturing, with low-skilled workers taking the brunt of the adjustment*" (Sachs and Shatz, 1994: 2). In line with Stolper-Samuelson proposition and having excluded computers, they find evidence, albeit weak, that supports the assertion that the prices of products produced by unskilled labour declined relative to the prices of products produced by skilled labour. They argue that although they are not certain on the weight of the trade effect, the evidence provided above illustrates a growing inequality of earnings between low- and high-skilled workers. What is instructive from these results is that the exclusion of computers yielded "*...a negative but statistically insignificant relationship between import price changes and skill intensity and they note that the size is small*" (Lawrence, 1995: 20). The implication is that their results do no provide a compelling case that trade between the US and developing countries has adversely affected the returns of unskilled workers in the US.

In another study, Slaughter and Swagel (1997) discredit the assertion commonly made by advanced countries that globalisation is detrimental to unskilled-workers either directly through immigration or indirectly through trade and capital mobility. The fear to trade with developing countries led Freeman (1995) to pose the question: "*Are your wages set in Beijing*?" However, Slaughter and Swagel (1997) note that these fears are not supported by empirical evidence for import competition. They contend that globalisation had a modest effect on wages, employment, and income inequality in the advanced economies and the culprit seems to be a change in technology that led to a pervasive shift toward skilled-workers at the expense of less skilled-workers. They conclude that even historical evidence shows that free trade and mobility of labour and capital improve global welfare and tend to mutually improve the national welfare of all countries involved.

With regard to countries in the South, Cornia and Court (2001) did not find support for the assertion that trade liberalisation helped to reduce inequality in the fast growing developing country exporters of manufactured products. The dis-

tributive impact of trade liberalisation in middle-income countries is mixed. Whilst trade liberalisation in East Asia was accompanied by a decreasing wage inequality, the experience of Latin America yielded the opposite results. These contrasting results are attributed to the importation of world-class technology by Latin America, which raised the returns of skilled workers and reduced the demand for the locally abundant unskilled workers. They conclude that it is unlikely that trade is the most important factor in causing increased income inequality in the recent past. Kohl and O'Rouke (2000) agree with this view, claiming that the effects of globalisation in the 20th century are swamped by other factors, particularly domestic factors and institutions affecting labour supply such as demographics, labour market flexibility and education.

Slaughter (1998 (b): 1454) points out that the papers cited above, in particular Lawrence and Slaughter (1993) and Sachs and Shatz (1994), used the consistency checks to test "*...whether observed product price changes were consistent with rising wage inequality in the sense that the relative price of skilled-labour-intensive products rose relative to those of unskilled-labour-intensive products*". First, Slaughter (1998(b)) admits that a consistency check falls short on quantifying the contribution of trade on actual factor-price changes. Second, although a consistency check addresses the broad intuition of the Stolper-Samuelson theorem, it regresses product-price changes on factor-employment levels of the zero profit conditions, thus violating one of the theorem's key elements. He notes that the appropriate approach is to use mandated-wage regressions, which follow directly from the zero-profit conditions.

3.4. PREVIOUS STUDIES ON SOUTH AFRICA

In one of the first studies ever conducted in South Africa regarding the role of trade on employment, Bell and Cattaneo (1997) used the factor content approach and find that the production of manufactured exports generated a significant increase in the share of total manufacturing employment between 1985 and 1993. Nevertheless, over the same period, the labour intensity of manufactured exports was lower than that of the manufacturing output as a whole and it was also declining. This relative decline slowed the growth of export expansion-associated employment. The labour intensity of exports was also lower than that of imports;

in addition it was declining relative to labour intensity of imports. Notwithstanding the above, the conclusion reached is that import substitution industrialisation policy may have been favourable to employment in the manufacturing industry. The change in the composition of exports from labour-intensive sectors and from the intensive use of blacks and Asians/coloureds suggests that South Africa's comparative advantage is not in (unskilled) labour-intensive manufacturing sectors. This brings into question the assertion that import liberalisation will benefit the low-income working class.

Bhorat (1999) finds that between 1970 and 1995 the impact of trade flows on employment was positive on all occupations, race groups and education cohorts. The gains in employment were, however, not shared equally; the higher skill and higher education category gained more than those in the bottom echelon. The evidence from the time series for manufacturing only showed that the early years of heavy protectionism insulated unskilled workers relative to skilled employees. However, this changed after 1988, especially during the period1993-1997 as the earlier situation was reversed. Trade liberalisation induced significant job losses in unskilled workers whilst the skilled workers benefited. Bhorat argues that this trend is expected to continue as trade liberalisation gains momentum.

Nattrass and Seekings (2000) find that key labour market trends predating globalisation still exist. The key trends observed were: (a) growing labour force owing to population growth; (b) rising unemployment rates; (c) declining unskilled employment in agriculture and mining; and, (d) declining non-agricultural formal employment in the private sector and rising productivity and real wages. Despite being unable to determine the role of globalisation directly; they suggested that trade liberalisation manifested itself in the combination of rising import penetration in labour-intensive sectors and growth in exports of capital-intensive sectors. Their general conclusion is that the overall impact (i.e. including indirect effects) of international trade was estimated to have been neutral to mildly positive (although they argue that the impact of trade on technology is almost certainly under-estimated by such calculations). These employments trends affect inequality primarily through the increased demand for skilled workers and declining demand for unskilled workers. The problem of declining demand for unskilled workers is

attributed to labour market regulation, which they claim is an impediment to the creation of employment for unskilled workers. In addition, they note that while capital subsidies (including agriculture) played a key role in the past, it is unclear what role they continue to play.

Edwards (2001) extended the study of Bell and Cattaneo (1997) by covering the period after trade liberalisation up to 1997. He used the factor content approach to analyse the net impact of trade (imports-exports) and his results accord with those of Bell and Cattaneo (1997). He finds the rapid structural shift in net trade away from the ultra-labour intensive sector continued unabated. The result is consistent with other results obtained using firm level data (Edwards: 2002). He finds that capital-intensive net exports continued after the acceleration of trade liberalization in 1993 due to a decrease in exports of ultra-labour intensive products combined with a rise in imports of these products. However, he warns that caution should be exercised when interpreting these results given that both the factors that explain the shifts and the role of trade liberalisation in contrast to changes in demand (domestic and international), labour productivity, technology and/or real wage are ambiguous.

Edwards (2001) finds that exports were able to create jobs to compensate for those lost due to import competition but that these jobs were not adequate to make a dent in unemployment in the economy. His findings corroborate the results obtained by Bhorat (1999), which also show that jobs were created for skilled workers. Where the two results differ is in relation to factors explaining the creation of employment of skilled workers. Bhorat (1999) and Edwards (2001) ascribe trade liberalisation and change in technology respectively to be the driving forces behind the creation of skilled employment. However, Edwards (2001) argues that it is not clear whether change in technology that is causing a structural shift away from low-skilled elementary employment is not influenced by trade. In addition, he argues that perhaps the observed structural shift away from low-skilled elementary employment can be explained by other factors such as global skill-biased technology or relative wage shifts.

Alleyne and Subramanian (2001) used the factor content approach and found that South Africa was revealed through trade to be relatively capital abundant. The country was a net exporter of capital-intensive products even when trading with high-income countries. They admit that a comprehensive understanding of this phenomenon would require an analysis of the labour market itself. Nonetheless, they argue that the evidence of the pattern of trade suggests that labour is expensive relative to capital in this country. This supports the assertion made by Nattrass and Seekings (2000) that attributes this to the lingering effect of apartheid policies that encouraged the under-utilization of labour resources via subsidies for capital intensive techniques; low average labour productivity (indicative of a low skill base) and relatively sticky wages; and, significant non-wage labour costs, including administrative and financial costs of compliance with aspects of the labour market legislation.

The paper by Edwards and Schoer (2002) suggests that the jury is still out with regard to factors causing the structural shift in South Africa. They state that possible factors include: first, trade liberalisation in this country coincided with the entry of countries such as China and India into the world market. Since these countries are endowed with an abundance of (unskilled) labour, their productions tend to be oriented towards (unskilled) labour intensive sectors. Second, the termination of sanctions and the readmission of South Africa into the world market culminated in the rise of exports into the SADC region. Since the exports of South Africa to SADC are skill and capital intensive, growth of such exports might have increased the capital and skill intensity of the South African trade. Last, in addition to the lingering effects of policies pursued by the previous government, the new government introduced policies such as Regional Industrial Development Programme (RIDP), the Simplified RIDP, and the General Export Incentive Schemes (GEIS), which could have inadvertently perpetuated the capital intensive mode of production.

Fedderke, Shin, and Vaze (1999) used the dynamic heterogeneous panel estimation instead of panel heterogeneity technique, which they criticise for not capturing either the dynamics or possible heterogeneous panel estimation that goes beyond fixed effects. They find strong evidence to support the presence of the

Stolper-Samuelson effects in South Africa. In particular, they obtained significant price increases in sectors that are labour intensive. While the increase in trade-mandated earnings was positive for both capital and labour, the increase in the latter was more than in the former. On the other hand, technology was found to have mandated an increase in negative-earnings for both capital and labour. The results obtained from the labour-requirements approach were consistent with the findings that labour-intensive sectors benefited significantly from trade. The main criticism attributed to their approach is that since, in the long run, the percentage change in output prices may be linked to factors other than changes in trade barriers, it is not clear how they have disentangled the role of these other factors from that caused by trade.

A major shortcoming of the studies cited above is that they treat technology led change as independent of trade. Furthermore, most of the studies that argue that technology led change is liable for the misfortunes of unskilled labour, both in developed and developing countries, fail to present the evidence showing that productivity has also improved (Lawrence: 1995). The studies also underestimate the effects of trade on labour because, according to Wood (1995: 67), import competition from low-wage countries, among others, compels developed-country firms to engage in defensive innovation that allows them "*...to fight off the imports*". Consequently, the demand for unskilled labour in the developed country drops and these exacerbate wage inequality. These concomitant adjustments are inadvertently attributed to technical change when in fact they are trade related.

What is instructive to note is that while many are opposed to trade liberalisation because of its alleged effects on unskilled workers, technology change explanation has somewhat escaped such opposition. As Straus-Kahn (2003: 23) aptly puts it "*whereas globalisation often incites strong criticism, it is rare to hear that technological progress should be limited because of its effect on income distribution*". These studies, with the exception of Alleyne and Subramanian (2001), assume that bilateral trade between a country and its different trading partners is uniform; hence, they look at aggregate trade between a country with all its partners instead of with each of its different partners as theory suggests. For instance, South Africa still exports mainly primary products to developed countries

and in turn imports value-added products. As Edwards and Schoer (2002) have shown, the country tends to export manufactured products to SADC. As indicated in the introduction, this paper in contrast to the existing studies addresses the problem associated with the difficulty of calculating prices accurately by using tariffs as a proxy for price change.

4. EMPIRICAL METHODOLOGY

Presented below are the two main approaches identified in the literature used to measure the effects of trade on labour: the factor content and product price approaches.

4.1. THE FACTOR CONTENT APPROACH

The factor content approach uses the quantity rather than the price of imports to measure the intensity of import competition. The factor content approach was traditionally used to test factor-proportions theory. According to this approach, merchandise trade between countries is similar to an exchange of factor services inherent in the products being traded. *Ceteris paribus,* this means that imports add more labour to the existing pool of the labour force in the recipient country and conversely reduces the amount of the labour force in the exporting country. Similarly, exports reduce the amount of the labour force in the importing country and in turn increase the amount of the labour force in the exporting country. According to Borjas, Freeman, and Katz (1992) [quoted from Slaughter, (1998 (b)], factor supplies (and not factor demands) are the conduit for transmitting the effects of trade to labour markets.

The Heckscher-Ohlin theory posits that a country will export products that intensively use the abundant factor and conversely import products that intensively use the scarce factor. However, in instances where the number of products exceeds the number of factors of production, "*output and hence trade flows can no longer be determined solely on the basis of a country's factor endowments. Indeed, it is precisely because of this potential indeterminacy of trade and production that many tests of the factor abundance theory have focused on the Heckscher-Ohlin-Vanek [hereafter, HOV] model* (Berstein and Weinstein, 2002:1)". According to the HOV model, countries will export the services of the relatively

abundant factors and by contrast import the services of the relatively scarce factors.

The factor content approach equation, which captures the essence of HOV theorem, states that a country will be a net exporter of its abundant factor and in return a net importer of its scarce factor (Alleyne and Subramanian, 2001):

$$AT = E_i - E_\omega \beta_i \qquad (I)$$

where *A* is the *m x n* matrix of technology coefficients whereby its typical element, a_{kj}, represents the k[th] factor used per unit of product j; *T* is the *n x l* vector of net exports; E_i is the endowment of factors of country i; E_ω is a vector of the world endowments and β_i is a scalar.

Using Q_i to represent a vector of outputs of country *i*, equilibrium in the factor market implies that

$$AQ_i = E_i \qquad (IIa)$$

Similarly equilibrium in the factor market for all countries will be given by

$$AQ_w = E_\omega \qquad (IIb)$$

Identical preferences and homothetic tastes imply that the consumption vectors C_i of each country are proportional to each other and to world output (Q_w): $C_i = Q_\omega B_i$

Country i's trade, T_i, is given by $T_i = Q_i - C_i$, and factors embodied in trade are

$$AT_i = A(Q_i - C_i) = E_i - AQ_w\beta_i = E_i - E_\omega\beta_i \qquad (III)$$

In the case of two factors of production, capital (K) and labour (L), the two equations derived from (III) above are;

$$K_T = K_i - \beta_i K_w; \text{ and} \qquad (IV)$$
$$L_T = L_i - \beta_i L_w$$

where K_T and L_T are capital and labour embodied in net trade. Relative factor endowments of a country can be deduced by comparing it with factor endow-

ments of the world. For example, according to Leamer (1980) a country is capital abundant if the ratio of capital to labour embodied in net export exceeds the ratio of capital to labour embodied in consumption provided it is a net exporter of both factors of production ($K_t / L_t > K_c / L_c$) or the ratio of capital to labour embodied in net import is less than the ratio of capital to labour embodied in consumption provided it is a net importer of both factors of production (i.e. $K_t / L_t < K_c / L_c$). Employing the same reasoning, a country is labour abundant if the ratio of labour to capital embodied in net export exceeds the ratio of labour to capital embodied in consumption or the ratio of labour to capital embodied in net import is less than the ratio of labour to capital embodied in consumption. Otherwise in the event of being a net exporter of one factor, a country will be considered to be abundantly endowed with the factor for which it is a net exporter and scarcely endowed in the factor for which it is a net importer.

The major shortcoming of using the factor content approach is that it is premised on the notion that it can operate independently of the factor price, although this is not supported by any theory (Leamer, 1996). The argument is that the factor content approach does not link product prices and factor payments as suggested by the Stolper-Samuelson theorem and, as Bhagwati aptly indicated, the chain of causation from trade to factor prices is mediated by the relative product prices changes (quoted from Lawrence, 1995). What the factor content approach does, which is in line with Heckscher-Ohlin-Vanek theorem, is to link relative factor endowments to factor content of net trade. As Deardorff and Staiger (1988) demonstrate, the factor content approach can estimate the effect of trade on wage inequality under restrictive assumptions.

As Slaughter (1998 (b): 1456) aptly puts it: "*These factor-content studies have triggered substantial methodological debate about the conditions under which trade volumes correctly identify the effect of trade on relative factor prices…Even today, disagreement remains about the empirical value of factor-content studies. Despite this, it is important to point out that the balance of evidence from both the SS studies and the factor-content studies reaches the same conclusion that trade has contributed a relatively small amount to rising U.S. skill premia.*"

4.2. THE PRODUCT PRICE APPROACH

The HOS model suggests that the changes in product prices are the conduit through which trade liberalisation affects changes in factor prices. Deardorff lists six **statements** associated with the Stolper-Samuelson (SS) theorem. For the purpose of this paper the "essential version" will be used. The "essential version" postulates that "*an increase in the relative price of a product increases the real wage of the factor used intensively in producing that product and lowers the real wage of the other factor*" (Slaughter, 1998 (a): 3). In short, the essence of the SS theorem is that the chain of events starts from the effects of international trade on the prices of goods market, and in turn product prices affect factor prices by affecting factor demands (Slaughter, 1998 (b)).

According to Leamer (1996), the foundation of the Stolper-Samuelson theorem is provided by the following zero-profit conditions[2]:

$$P = AW \qquad (1)$$

Where P is an (N x 1) vector of N domestic product prices, W is an (M x 1) vector of M domestic factor prices and A is an (N x M) matrix of input intensities whose a_{ij} elements is the number of units of factor i per unit output j. Equation 1 states that price for each product equals average cost (Slaughter, 1998 (a)). Since it is assumed that factors of production can move freely between sectors, it is redundant to index factor prices by industry because "*...each factor has only one national price*" (Slaughter, 1998 (a): 4). By differentiating these zero profit conditions while assuming no technological progress yield:

$$\hat{P} = \theta \hat{W} \qquad (2)$$

When technological progress is not held constant, the equation becomes:

$$\hat{P} = \theta \hat{W} - T \hat{F} P \qquad (2a)$$

Alternatively, equation (2a) can be written as follows:

[2] For detailed exposition on how these equations are derived, see Leamer (1996).

$$\hat{P} + T\hat{F}P = \theta\hat{W} \qquad (2c)$$

Note that $\hat{P}, \hat{W}, T\hat{F}P, and\theta$ represent the percentage change in prices, wages, total factor productivity respectively and θ_{ij} is the (*N x M*) initial shares of the factor i in the average cost of producing one unit of product j. Equation 2c illustrates the changes in factor costs required to maintain the zero profits condition given the respective changes in price and total factor productivity. What equations 2, 2a , and 2c show is that product price changes give rise to factor price changes (Slaughter, 1998 (a)). This is irrespective of whether the product-price changes are caused by international trade, technological progress or any other force.

In an effort to distinguish among the effects brought about by technological change, globalisation and other factors, it becomes necessary to redefine Equation 2 (b). Recognizing that the technological growth in a large country can find expression in product price changes, then "*a common "pass-through" rate is assumed for all sectors meaning that a given percent of the technological improvement is passed on to consumers in the form of lower prices*" (Leamer, 1996: 5-6). In his view, this will help to facilitate the task of separating the effects of technological growth from that of globalisation. To this end,

$\hat{P} = -\lambda T\hat{F}P_j$, where λ is the pass-through rate common across all sectors. In a small country, the pass through is zero (i.e. λ=0). Substituting the above pass through equation of technology change to Equation 2c yields the effect of technology change on wages:

$$T\hat{F}P_j - \lambda T\hat{F}P_j = \theta_j\hat{W} \qquad (3)$$

Alternatively, Equation 3 can be written as follows:

$$(1-\lambda)T\hat{F}P_j = \theta_j\hat{W} \qquad (3a)$$

Lastly, the equation for the globalisation effect on wages is:

$$\hat{P}_j + \lambda T \hat{F} P_j = \theta_j \hat{W} \qquad (4)$$

By imposing the small country assumption of zero pass-through technological change onto product prices helps to estimate the mandated wage regressions (Leamer, 1996):

$$\hat{P}_j = \phi_m \gamma_{mj} + \phi_l \gamma_{lj} + \phi_k \gamma_{kj} + \varepsilon_j \qquad (5)$$

where γ_{mj}, γ_{lj}, γ_{kj} and ε_j are the initial shares of intermediate products, an average cost of labour and capital required to produce a single unit of product j, and error term respectively. A change in value added can be derived by deducting price changes of intermediate products from price changes of finished products. Therefore, these coefficients represent the changes in wages consistent with movement in product prices. Consequently, these coefficients can then be compared to actual wage movements to ascertain the contribution of trade to wage movements. Since the cost shares total 100%, the regression is estimated without an intercept term.

Alternatively, the following function can be estimated:

$$\hat{P}_j - \sum^{N} a_{ij} \hat{P}_j = \phi_l \gamma_{lj} + \phi_k \gamma_{kj} + \varepsilon_j \qquad (6)$$

where a_{ij} is the amount of intermediate input units i required to produce one unit of product j.

So ϕ_l and ϕ_k are compared to establish how price changes have impacted on the factor returns. Therefore if $\phi_l > \phi_k$, then price changes mandated rising returns to labour relative to capital. This line of reasoning can be employed in the case of skilled and unskilled workers when these two skill categories are compared. It is

imperative to assume that the product mix remained the same for the whole period under review and this implies that a country does not change its cone of diversification lest the systematic linkages between movements in product prices and factor returns, respectively, will be broken.

Another approach used to assess the Stolper-Samuelson theorem is the 'consistency checks' approach. This approach determines the sector-bias of product price changes and thereupon makes inferences regarding whether the bias is in line with changes in relative factor returns over the period under review. The typical equation is given by:

$$\hat{P}_j = \alpha + \beta(FR)_j^{initial\ year} + \varepsilon_j \qquad (7)$$

where P_j and ε_j are the change in price and error term of product j whilst $(FR)_j$ could either be the ratio of unskilled workers in total employment [i.e. (Unskilled)/(Unskilled+Skilled)] or the amount of wage that has accrued to labour as a ratio of total factor returns in industry j (i.e. Wage bill)/(Wage bill + Rent bill), the ratio of labour to capital (i.e. L/K) or the ratio of factor returns (i.e. Wage bill/Rent bill). If $(FR)_j$ represents the ratio of unskilled workers in total employment in industry j [i.e. (Unskilled)/(Unskilled+Skilled)] then positive β coefficient implies that price changes have been biased towards labour intensive sectors. According to the SS theory, this is consistent with rising unskilled labour wages relative to skilled labour wages. The major weakness of this method is that it fails to quantify the change in factor prices actually brought about by the product price changes (Slaughter, 1998 (b)).

5. DATA AND RESULTS

The data used in this paper is sourced from the Trade and Industry Policy Strategies (TIPS) database and Statistics South Africa (StatSA). The Standard Industrial Classification, that is SIC 3 and SIC 4-digits, data were used. The former is derived from the TIPS database while the latter is obtained from the Supply-Use table of Statistics South Africa.

The student version of Eviews, namely version 3.1, is used in this paper. Since services sectors are excluded in both approaches, 32 sectors and 79 sectors are used in the case of SIC 3 and SIC 4-digits data respectively. The period covers the inception of the TDCA and the time the agreement will be fully implemented, that is from 2000 to 2012. As already indicated in section 2, the TDCA covers tariff phase down of 86%of South African products while in the case of the EU about 95% tariffs of their products will be eliminated.

In all the regression used in this paper, changes in prices are measured as the change in tariffs between the years 2000 and 2012, using the following equation: % Price $\Delta = ((1 + t_f/100)/ (1 + t_i/100))-1$. According to the TDCA' tariff elimination schedule of South Africa, t_f and t_i represent final and initial tariffs for the period 2012 and 2000 respectively.

5.1. DISTRIBUTION OF TRADE

The EU is South Africa's major trading partner and the significance of this market remained stagnant over the period under review (see Table 2 below).

Table 2: Bilateral trade between South Africa and the EU

	1990	1994	1999	2000	2001	2002	2003
$SA\text{-}EU_{(E+M)}/SA\text{-}RoW_{(E+M)}$	30.70%	30.23%	31.41%	31.01%	32.15%	33.41%	33.82%
$SA\text{-}EU_{(E)}/SA\text{-}RoW_{(E)}$	20.99%	20.31%	27.40%	27.07%	27.65%	28.44%	28.03%
SA's imports from the EU/SA's imports from the RoW	43.62%	41.07%	35.66%	35.20%	37.04%	38.36%	39.15%
SA's exports to EU (Rm 1995 prices)	18836	20470	34740	37522	38886	38579	38250
SA's imports from EU (Rm 1995 prices)	29410	37901	42656	45859	47997	52249	58100
SA's exports to RoW (Rm 1995 prices)	89737	100801	126799	138624	140646	135654	136445
SA'imports from RoW (Rm 1995 prices)	67420	92293	119612	130277	129593	136190	148407

Source: Own calculations using SIC 3 data from TIPS database

Examination of Table 2 reveals that by the end of 2003 the EU was accounting for about one third of South Africa's trade (i.e. exports plus imports). The share of trade accounted for by EU rose by 3% from the time of the implementation of the TDCA until 2003. The share of trade with South Africa was stable between 1990 and 2000. Given that the TDCA provides for early and rapid EU tariff elimination in most of its products, South Africa was able to register a marginal growth in export between 2000 and 2003. It should be noted, as indicated earlier, that the large share of its products already enter the EU market free of tariffs (see Section 2). However, the share of South African exports to the EU grew from 20.99% in 1990 to 28.03% in 2003. Similarly, the share of South African imports from the EU declined from 43.62% in 1990 to 39.15 in 2003. But the share of South African imports from the EU increased from 35.20% in 2000 to 39.15% in 2003. This increase took place at the time when the benefits of the TDCA have not filtered through to EU products given that the agreement mandates South Africa to eliminate tariffs only from 2006. Prior to this period, the share of EU imports declined from 44% in 1990 to 35% in 2000. Although the role of the South African currency is not tested in this paper, other studies have shown that before 2001, South African exports were driven by the depreciating currency while after this period imports were given new impetus by the strengthening of the currency.

5.2. THE FACTOR CONTENT APPROACH RESULTS

The results of the factor content approach are presented in Annexure A in the Appendix. Examination of Annexure A shows that South Africa is revealed to be abundant in capital and unskilled workers for the period 2000-2003. What is evident is that the abundance of capital and unskilled worker existed since 1990.

Annexure A shows that between 1990 and 2003, labour embodied in net imports rose by about 88,09% while capital embodied in net exports dropped by about 29.42%. Alternatively put, 1000 rand of net import in 1990 was tantamount to an import of 6,709 workers. By contrast, 1000 rand of net export is similar to an export of R894 capital. In 2003, the figures rose to 12,619 thousand workers and dropped to R613 capital. A paper by Alleyne and Subramanian (2001) also demonstrates that capital abundance in South Africa was revealed in its trade with

high -income countries. These findings resonate with the results obtained for Latin American countries (Turrini, 2002).

The HO theory predicts that a country such as South Africa will be revealed in its trade with developed countries to be unskilled labour abundant but not capital abundant. One of the cited explanatory factors for capital abundance in South Africa is that the country is richly endowed with mineral resources that in turn are assumed to be inherently capital intensive in their production. Since the integration of the South African economy into the global trade coincided with an active role of China and India in global trade, it is probable that South Africa is unskilled labour abundant only at a local level while China and India are unskilled labour abundant at a global level (Davis,1996). It is also possible that the trade reform was complemented by an entry of FDI into South Africa. Hanson (2003) explains that in Mexico, FDI brought skilled-labour-bias capital into that country and it is likely that the same phenomenon might have occurred in South Africa.

Annexure B shows that from 1990 to 2003, capital-labour ratio increased in real terms in all sectors, save for agriculture, forestry and the fishing sector. In contrast to the findings of Alleyne and Subramanian (2001), agriculture, forestry and the fishing sector is the most labour intensive sectors. Coke and refined petroleum products (89.61%), basic non-ferrous metals (47.72%), basic chemicals (29.14%), and basic iron and steel (19.85%) were the sectors that registered the most increase in capital-labour intensity, which is defined as an increase of 20% and more. Edwards and Golub (2003) find that South African productivity was below that of the newly industrializing countries, with little prospects for catching up. In addition, they find that "*...improvement in labour productivity during the 1990s appears to be related to capital-labour substitution. These findings are disconcerting insofar as sustainable long-run output and employment growth depends on raising productive efficiency rather than on capital-labour substitution and labour shedding*" (Edwards and Golub (2003: 677).

Depending on whether prices of the South African-traded products were affected by capital and unskilled workers abundance, the former might not augur well for income distribution while the latter will, indeed, narrow wage distribution between

skilled and unskilled labour. This matter is tested directly using the price approach that follows below.

5.3. PRICE APPROACH RESULTS

In this section, the impact of the TDCA on factor returns is estimated using the price approach method. When performing the diagnostics on the data, it emerged that the data is not normally distributed. However, in line with theory, price was differenced while the ratio of factor returns was left in levels form (see Annexure C). Presented in Table 3 below are the results of the consistency regressions using SIC 4-digit data. Given that the wages of skilled and unskilled labour in the Supply-Use tables are not disaggregated, it was not possible to ascertain the effects of price change on their wages (see Annexure D).

Table 3: The factor bias of price changes due to trade liberalisation using SIC 4-digit data (2000-2012): Consistency-check regression, results of equation 7

Factor ratios	Database	Observations	Coefficient
a. Labour returns/ total returns (manufacturing and agriculture only	SIC4-digit	79	-0.0005** (0.0517)
Adj R^2			0.0359
F-stat			3.9055
Prob(F-stat)			0.0517
b. Labour returns/ total returns (manufacturing sector)	SIC4-digit	75	-0.0443* (0.0909)
Adj R^2			0.0255
F-stat			2.9352
Prob(F-stat)			0.0909

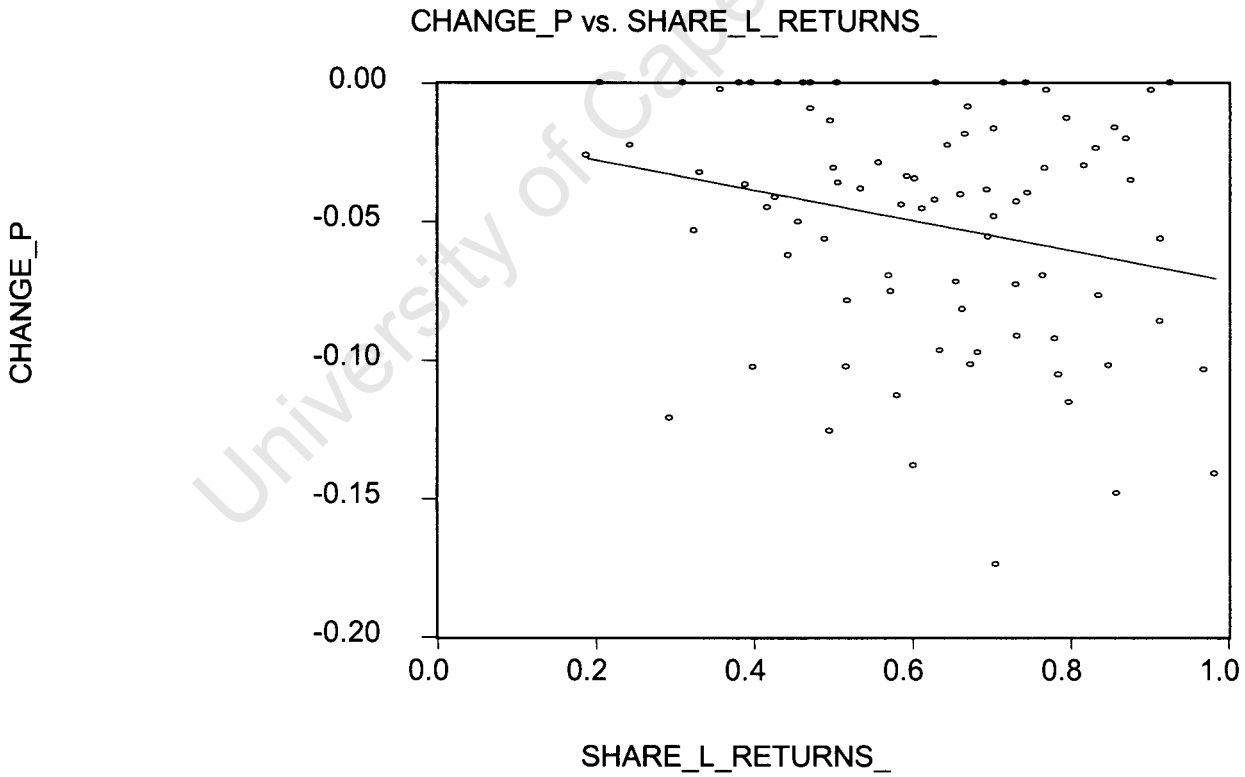
Notes: The ***, **, and * reflect 1percent, 5 percent, and 10 percent significance levels. Figures in parentheses represent the p-values of the coefficients.

In Table 3, the negative coefficients imply that the tariff reductions have been biased against labour intensive sectors. Under the SS theorem this would imply that the TDCA gives rise to a reduction in wages relative to rent. This result is not

consistent with the predictions of HO theory considering that South Africa is a developing country. Notwithstanding the above, the result lends support to that obtained in the factor content section where South Africa was revealed in its trade to be capital abundant. Therefore, the consistency approach results further show that factor returns are biased to capital.

It is important to note that the results were significant at 5% when manufacturing and agricultural sectors were included in the regression. But when the manufacturing sector is considered alone, the coefficient remained negative but was significant at 10%. This provides support to the notion that the agricultural sector in South Africa is becoming capital intensive. Although the results of SIC 3-digits data are not shown, there was no factor bias evident; hence, no significant price changes took place either in unskilled- or skilled labour intensive sectors.

Figure 2: Consistency Approach Graph, 2000-2012



The factor bias is evident from Figure 2: significant price changes are taking place in labour intensive sectors. The results were negative and significant at the 5% level when the agriculture and manufacturing sectors were included in the regression. However, when the manufacturing sector is considered alone, the coefficient remained negative but significant at the 10% level. This is in line with

South Africa's tariff liberalisation, as shown in Table 1: significant tariff reduction will take place in most of the labour-intensive sectors. This is in contrast to the predictions of the Stolper-Samuelson theorem in the case of a developing country since such a sector bias of price change causes a decline in the returns to labour relative to capital.

In an effort to estimate the change in factor returns mandated by the change in product prices, a mandated wage regression is performed. In the mandated-wage regression, tariff changes between the years 2000 and 2012 (used as a proxy for product-price changes) are the dependent variables; sectorial factor cost shares the independent variables while the factor-price changes are the parameters to be estimated. Thus product-price changes are regressed on the shares of factor returns to ascertain whether factor returns are consistent with the aforementioned factor-price changes. In order to determine factor-price changes explained by product-price changes, a comparison is made between actual factor-price changes with mandated factor-price changes.

Table 4: Mandated-wage regressions using equation 9:2000-2012

Factor ratio	Database	Observations	Coefficients
1. Manufacturing and agriculture	SIC-4	79	
Share of capital cost			0.0005 (0.9728)
Share of labour cost			-0.0690*** (0.0000)
Adj R^2			0.0362
2. Manufacturing only	SIC-4	75	
Share of capital cost			-0.0075 (0.6388)
Share of labour cost			-0.0702*** (0.0000)
Adj R^2			0.0772

Notes: The ***, **, and * reflect 1%, 5 %, and 10 % significance levels. Figures in parentheses represent the p-values of the coefficients.

Table 4 presents the results of the mandated-wage regressions based on Equation 9. The mandated-wage regression results were performed for the two sce-

narios as indicated above. On closer inspection of the results in Table 4, it emerged that, for both scenarios, tariff liberalisation necessitated by the TDCA mandated an increase in the returns of capital ranging between 0.05% and 0.75% and a decline in the returns of labour ranging between 6.90% and 7.02%. However, in both scenarios, the coefficients of labour remain significant at 1% level and by contrast that of capital is insignificant. Since the mandated decline in wages in both scenarios is more than the 5.21% decline in product-prices (see Table 1), this implies a decline in real wages for labour ranging from 1.69% in the manufacturing and agriculture sectors scenario and 1.81% in the manufacturing sector only scenario. Employing similar reasoning, tariff liberalisation necessitated by the TDCA gives rise to an increase in the real returns of capital in both scenarios, albeit the coefficients of capital are not significant in both scenarios. One plausible explanation why the return of capital is not significant could be attributed to modest price changes in capital-intensive products owing to the TDCA (see Table 1). These results differ from that of Fedderke et al (1999) who find the earnings of both labour and capital to be positively affected by trade and, in addition, that the changes of labour earnings were greater than the changes of capital returns.

To the extent that the value of an FTA is proportional to the magnitude of the protective barriers it attempts to overcome it is not odd that the TDCA will culminate in reduction of real wages relative to the returns of capital, given the prevalent distortions both in the goods and factor markets before the integration of the South African economy into the global trade. As indicated in the paper of Tsikata (1999), South Africa provided more protection to labour-intensive industries relative to capital-intensive industries (see Table 1 which shows that huge tariff reduction will take place in labour intensive sectors). Then the inference to be drawn is that since a huge tariff reduction was expected to take place in the unskilled-labour industries, this could result in wages of unskilled labour decreasing relative to that of skilled-labour, in line with the Stolper-Samuelson effects. This line of reasoning is used by Hanson (2003) to explain why skill premia in Mexico has increased following trade reforms which was necessitated by the implementation of NAFTA.

CONCLUSION

The objective of this paper is to assess the impact of tariff reduction in response to the TDCA on (a) the demand for labour and (b) factor returns. To this end, two methodologies were employed, namely the factor content and the price approach. The factor-content approach revealed South Africa through its trade with the EU to be capital and unskilled-labour abundant respectively. This implies that the returns of labour declined relative to that of capital; similarly the returns of skilled-labour also declined relative to that of unskilled-labour. This stems from the factor-content approach, which views trade as being synonymous to trade in factor services. By virtue of South Africa being a net importer of labour intensive- and skilled intensive-products respectively, the implication is that that there is a supply of labour and skilled-labour into the country. Capital abundance in a developing country is not in line with the predictions of the HO theory; however in the case of South Africa like Mexico, this is attributed to significant protection accorded to labour intensive sectors. In addition, increasing capital intensity in South Africa shows no signs of abating save in the agriculture, forestry and fishing sectors. As Edwards and Golub (2003) point out, prospects for sustainable long-run output and employment growth are jeopardised by capital intensity and labour shedding.

The results obtained in the price-approach supported that of the factor-content approach. The 'consistent approach' yielded negative coefficients when the change in product prices was regressed to the ratio of the returns to labour to total factor returns. This implies that the tariff reductions were biased against the labour-intensive sectors. Under the SS theorem, this would imply that the TDCA gives rise to a reduction in wages relative to rent. The mandated wage regression for the two scenarios yielded between 6.90% and 7.02% decrease in wages over the period 2000-2012. Since the mandated decline in wages in both scenarios is more than the 5.21% decline in product-prices, this implies a decline in real wages for labour ranging from 1.69% in the manufacturing and agriculture sectors scenario and 1.81% in the manufacturing sector only scenario. The results suggest that the TDCA will exacerbate wage inequality in South Africa. Of equal importance is that only the coefficients of labour were significant and the regression explained less than 10% of wage distribution in this country.

According to Slaughter (1998 (b)), efforts by government to reduce wage inequality through the provision of skills to unskilled workers will not be effective in the one-cone HO model. What militates against government intervention is that, in this framework provision of education is immaterial because changes in the supply of unskilled or skilled workers have no effect on wages (Leamer, 1996). This being the case, wage inequality will not be eliminated by educating unskilled workers because the wages of unskilled workers who would not benefit from such government initiatives will not improve.

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APPENDIX

ANNEXURE A: FACTOR CONTENT OF TRADE (SIC 3)

Structural shifts in trade (assumed 1995 labour & capital, skilled & unskilled coefficients respectively)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Export & Import														
L_x (1)	111761	114806	109349	112528	126255	160656	186499	210420	194328	209779	214718	215447	209356	227192
K_x(2)	4754	4597	4417	4663	5452	6885	9023	9430	8441	7764	7634	7828	8175	8278
L_m (3)	122250	111431	117650	117595	158832	182053	187755	191137	188812	173417	183800	189414	207659	228921
K_m(4)	122250	111431	117650	117595	158832	182053	187755	191137	188812	173417	183800	189414	207659	228921
Equation=(2/1)/(4/3)	0.0425	0.0400	0.0404	0.0414	0.0432	0.0429	0.0484	0.0448	0.0434	0.0370	0.0356	0.0363	0.0390	0.0364
S_L_x (9)	5388	5268	5260	5400	5922	8042	9315	10399	10470	11157	12336	12839	12473	12392
US_L_x (10)	87562	90791	86059	88649	99382	124766	144649	164773	149410	162066	162813	160766	154901	173805
S_L_m (11)	14452	13271	13939	13839	19110	22018	22693	22838	23673	21259	22748	23500	25407	28761
US_L_m (12)	71974	65906	70076	69910	93222	107489	109426	113156	110631	102023	108059	110907	122554	133193
Equation=(9/10)/(11/12)	0.3064	0.2881	0.3073	0.3077	0.2907	0.3147	0.3105	0.3127	0.3275	0.3304	0.3599	0.3769	0.3884	0.3302
Real Net Trade														
Labour (L_t)	-6709	7431	58	-8201	-39158	-21395	-9192	16554	-5252	18769	13567	13177	-1237	-12619
Capital (K_t)	894	1474	1279	1188	1207	1814	3860	3936	3923	3350	2564	2674	2309	631
Consumption														
Labour (L_c)	2629661	2595185	2576390	2483653	2522024	2590735	2586301	2504619	2433070	2337435	2318231	2253664	2267235	2294153
Capital (K_c)	52283	51620	52979	55011	60101	66396	72066	79486	84341	88819	93628	97110	107140	122167
Kt/Lt	-0.1333	0.1984	22.0551	-0.1448	-0.0308	-0.0848	-0.4200	0.2378	-0.7471	0.1785	0.1890	0.2029	-1.8655	-0.0500
Kc/Lc	0.0199	0.0199	0.0206	0.0221	0.0238	0.0256	0.0279	0.0317	0.0347	0.0380	0.0404	0.0431	0.0473	0.0533

Leamer' s methodology is employed[3] **Real Net Trade**	**1990 K intensive**	**1991 K intensive**	**1992 K intensive**	**1993 K intensive**	**1994 K intensive**	**1995 K intensive**	**1996 K intensive**	**1997 K intensive**	**1998 K intensive**	**1999 K intensive**	**2000 K intensive**	**2001 K intensive**	**2002 K intensive**	**2003 K intensive**
Skilled labour (St)	-8169	-7292	-8222	-8297	-13349	-13975	-13975	-11532	-13757	-10653	-10496	-10274	-11447	-15663
Unskilled labour trade (USt)	19581	28368	23825	16004	711	17278	28004	45385	28278	43470	37081	34604	23136	25147
Consumption														
Skilled labour (Sc)	147089	151129	155033	157236	168315	176822	185836	181464	186623	180215	180465	179047	184462	190270
Unskilled labour (USc)	1964729	1933264	1916386	1830453	1840346	1891291	1861821	1803743	1731994	1660015	1646682	1593244	1588495	1609153
St/USt	-0.4172	-0.2571	-0.3451	-0.5184	-18.777	-0.8088	-0.4990	-0.2541	-0.4865	-0.2451	-0.2830	-0.2969	-0.4948	-0.6228
Sc/USc	0.0749	0.0782	0.0809	0.0859	0.0915	0.0935	0.0998	0.1006	0.1078	0.1086	0.1096	0.1124	0.1161	0.1182
Leamer' s methodology is employed[4]	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**	**Unskilled intensive**

[3] Leamer methodology is applied in the case of unbalanced trade: it states that if Kt/Lt>Kc/Lc (if net exporter of both) or Kt/Lt<Kc/Lc (if net importer of both) indicates capital abundance and conversely if Lt/Kt>Lc/Kc (if net exporter of both) or Lt/Kt<Lc/Kc (if net importer of both) indicates labour abundance. Otherwise it is abundant in the factor in which it is net exporter of (i.e. if it does not a net importer or exporter respectively both factors).

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ANNEXURE B: FACTOR CONTENT OF TRADE (SIC 3)

Capital-labour ratio[5]

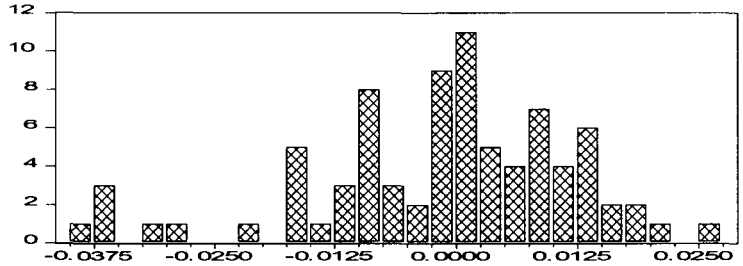
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	%change
1. Agriculture, forestry and fishing	0.89	0.81	0.73	0.70	0.72	0.74	0.83	0.87	0.86	0.81	0.77	0.75	0.81	0.82	-0.07
2. Coal mining	2.76	3.52	4.26	5.54	5.92	6.18	6.34	6.84	7.62	8.76	9.72	10.11	10.60	9.97	7.22
3. Gold and uranium ore mining	2.91	3.03	3.08	3.06	2.93	2.90	3.05	3.03	3.76	3.89	3.95	4.09	4.06	3.83	0.92
4. Other mining	11.71	12.19	12.88	13.07	9.23	9.28	9.31	9.87	11.20	11.94	12.39	12.66	12.92	14.25	2.54
5. Food	0.94	0.97	1.14	1.40	1.78	2.17	2.44	2.88	3.13	3.09	3.10	2.89	2.73	2.80	1.85
6. Beverages	3.50	4.01	4.91	6.26	6.96	7.52	7.78	8.32	9.18	10.16	12.53	14.34	15.69	14.52	11.02
7. Tobacco	3.67	4.42	6.43	6.66	6.62	6.08	5.53	5.26	5.16	5.07	6.76	7.17	7.73	8.01	4.34
8. Textiles	1.04	1.02	1.00	1.13	1.08	1.30	1.31	1.51	2.14	2.26	2.20	2.23	2.16	2.13	1.09
9. Wearing apparel	0.27	0.26	0.26	0.23	0.25	0.27	0.28	0.34	0.40	0.38	0.37	0.37	0.35	0.43	0.16
10. Leather and leather products	0.25	0.29	0.39	0.50	0.61	0.67	0.81	0.81	0.90	0.80	0.92	1.35	1.85	1.94	1.69
11. Footwear	0.25	0.26	0.31	0.34	0.36	0.40	0.45	0.45	0.42	0.45	0.48	0.52	0.47	0.42	0.17
12. Wood and wood products	0.46	0.49	0.56	0.58	0.58	0.68	0.80	0.87	0.75	0.79	0.75	0.87	0.91	0.86	0.40
13. Paper and paper products	4.10	3.81	3.67	3.91	4.48	5.32	6.54	7.68	8.98	10.08	10.65	11.49	11.72	12.20	8.10
14. Printing, publishing and recorded media	1.09	0.95	0.98	1.18	1.63	2.19	2.81	3.35	3.50	3.08	2.68	2.35	2.06	1.76	0.67
15. Coke and refined petroleum products	22.21	20.69	22.59	25.75	29.28	33.61	38.78	47.67	57.70	76.72	91.61	109.18	129.20	111.82	89.61
16. Basic chemicals	11.66	10.74	10.34	9.99	10.41	12.23	15.25	19.56	18.09	22.14	27.46	32.34	34.94	40.80	29.14
17. Other chemicals and man-made fibers	3.46	3.15	3.21	3.33	3.66	3.78	3.94	4.33	4.28	4.71	4.37	4.79	4.71	4.55	1.10
18. Rubber products	1.84	2.00	2.39	2.74	3.04	3.21	3.50	4.14	4.64	4.71	4.72	5.22	5.85	6.54	4.69
19. Plastic products	1.17	0.95	0.75	0.61	0.59	0.54	0.63	0.75	0.88	1.30	1.57	1.91	2.04	2.01	0.85
20. Glass and glass products	1.71	1.63	1.70	1.92	2.78	4.55	6.39	7.81	9.92	9.82	9.27	8.27	7.68	9.42	7.71
21. Non-metallic minerals	3.66	3.54	3.55	3.44	3.75	4.14	4.56	5.50	7.81	9.90	11.33	11.95	12.31	12.58	8.93
22. Basic iron and steel	5.79	6.10	6.96	8.29	10.19	12.26	15.43	20.12	25.75	30.64	33.93	30.01	27.88	25.64	19.85
23. Basic non-ferrous metals	6.29	7.24	9.76	15.22	20.53	25.58	31.15	32.27	32.51	33.56	40.38	42.42	43.36	54.01	47.72

[5] Capital-labour ratio was calculated using the following formula: $\frac{\text{Capital-output ratio (R'000 at 1995 prices)}}{\text{Labour-output ratio (R'000 at 1995 prices)}}$

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	%change
24. Metal products excluding machinery	0.78	0.92	1.27	1.64	1.88	2.15	2.19	2.25	2.28	2.39	2.38	2.35	2.24	2.18	1.40
25. Machinery and equipment	0.93	0.93	0.96	0.98	0.95	0.95	1.01	1.10	1.17	1.27	1.46	1.61	1.71	1.78	0.85
26. Electrical machinery and apparatus	0.46	0.36	0.33	0.35	0.42	0.50	0.59	0.63	0.61	0.66	0.68	0.74	0.76	0.80	0.33
27. Television, radio and communication equipment	0.95	0.76	0.71	0.84	1.06	1.42	1.44	1.92	1.37	1.43	1.67	2.23	2.92	3.11	2.16
28. Professional and scientific equipment	0.72	0.66	0.66	0.74	0.56	0.52	0.56	0.76	1.04	1.26	1.56	1.96	2.20	2.86	2.15
29. Motor vehicles, parts and accessories	1.70	2.02	2.56	3.08	2.99	2.76	2.73	3.20	3.71	4.62	5.53	6.39	7.36	8.07	6.37
30. Other transport equipment	0.34	0.37	0.63	1.27	2.02	2.81	3.36	4.02	5.28	5.28	6.06	4.99	4.52	6.02	5.69
31. Furniture	0.29	0.26	0.25	0.24	0.28	0.34	0.41	0.53	0.61	0.66	0.64	0.60	0.51	0.48	0.19
32. Other manufacturing	1.47	1.46	1.51	1.44	1.28	1.13	1.05	1.44	2.23	2.84	3.33	3.85	4.38	5.13	3.66

ANNEXURE C: PRICE APPROACH (DIAGNOSTICS)

1. Normality test



Series: Residuals	
Sample 2000 2080	
Observations 81	
Mean	-0.001139
Median	6.62E-05
Maximum	0.027162
Minimum	-0.037609
Std. Dev.	0.013732
Skewness	-0.757063
Kurtosis	3.554104
Jarque-Bera	8.773672
Probability	0.012440

2. Test for Heteroskedasticity

ARCH Test:

F-statistic	0.423199	Probability	0.517257
Obs*R-squared	0.431708	Probability	0.511152

Test Equation:
Dependent Variable: RESID^2
Least Squares
Date: 02/06/05 Time: 21:09
Sample(adjusted): 2001 2080
Included observations: 80 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000176	4.13E-05	4.262787	0.0001
RESID^2(-1)	0.073318	0.112703	0.650538	0.5173

ANNEXURE D PRICE APPROACH RESULTS

	New shares_intermediate_cost($\sum^N a_{ij}\hat{}P$)	Change_P	$\sum^N a_{ij}\hat{}P$	$\hat{}P - \sum^N a_{ij}\hat{}P$	Rent	Wages	Initial intermediate cost shares	Share_K_cost	Share_L_cost	Share_L_returns_tot_costs [6/(5+6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Agricultural products	0.7722	-0.0326	-0.0252	-0.0074	16839.6511	8380.2589	0.4943	0.3407	0.1695	0.3323
2. Coal and lignite products	0.4288	0.0000	0.0000	0.0000	4837.4362	4181.9679	0.4855	0.2688	0.2324	0.4637
3. Gold and uranium ore products	0.7184	0.0000	0.0000	0.0000	3817.5084	11126.7394	0.4504	0.1374	0.4006	0.7445
4. Other mining products	0.3405	-0.0025	-0.0009	-0.0017	14805.3123	8303.4250	0.4331	0.3594	0.2015	0.3593
5. Meat products	0.9155	-0.0188	-0.0172	-0.0016	390.4160	783.1664	0.9408	0.0194	0.0389	0.6673
6. Fish products	0.6443	0.0000	0.0000	0.0000	403.2453	361.9078	0.4956	0.2624	0.2355	0.4730
7. Fruit and vegetables products	0.6534	-0.1381	-0.0903	-0.0479	484.4567	733.7172	0.6925	0.1212	0.1836	0.6023
8. Oils and fats products	0.7599	-0.0309	-0.0235	-0.0074	363.3077	366.1237	0.8023	0.0974	0.0982	0.5019
9. Dairy products	0.7426	0.0000	0.0000	0.0000	649.7814	1111.1169	0.7130	0.1044	0.1786	0.6310
10. Grain mill products	0.8155	-0.0453	-0.0369	-0.0084	1304.6553	936.9774	0.7514	0.1421	0.1021	0.4180
11. Animal feeds	0.8573	-0.0385	-0.0330	-0.0055	316.4852	366.1930	0.8352	0.0747	0.0865	0.5364
12. Bakery products	0.6862	-0.1740	-0.1194	-0.0546	481.2387	1159.7286	0.6363	0.1048	0.2525	0.7067
13. Sugar products	0.6477	0.0000	0.0000	0.0000	776.9659	591.0096	0.6464	0.1986	0.1510	0.4320
14. Confectionary products	0.6473	-0.0974	-0.0631	-0.0344	290.3699	627.7875	0.6164	0.1200	0.2595	0.6837
15. Other food products	0.6290	-0.1257	-0.0791	-0.0466	1028.9808	1015.6140	0.6522	0.1730	0.1707	0.4967
16. Beverages and tobacco products	0.6959	-0.1210	-0.0842	-0.0368	7756.7972	3235.3863	0.5926	0.2816	0.1174	0.2943
17. Textile products	0.7495	-0.0925	-0.0693	-0.0232	361.3990	1290.3332	0.7263	0.0604	0.2156	0.7812
18. Made-up textile products	0.6792	-0.1483	-0.1007	-0.0476	103.0291	629.2879	0.6902	0.0433	0.2645	0.8593

	New shares_intermediate_cost($\sum^N a_{ij}\hat{}P$)	Change_P	$\sum^N a_{ij}\hat{}P$	$\hat{}P - \sum^N a_{ij}\hat{}P$	Rent	Wages	Initial intermediate cost shares	Share_K_cost	Share_L_cost	Share_L_returns_tot_costs [6/(5+6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
19. Carpets	0.7346	-0.1154	-0.0848	-0.0306	37.3486	148.3376	0.7588	0.0502	0.1993	0.7989
20. Other textile products	0.7507	-0.0769	-0.0577	-0.0192	50.7289	259.1059	0.6678	0.0546	0.2791	0.8363
21. Knitting mill products	0.6487	-0.1037	-0.0673	-0.0364	17.4479	568.6089	0.7057	0.0088	0.2860	0.9702
22. Wearing apparel	0.6732	-0.1412	-0.0950	-0.0461	52.7650	3286.7979	0.6340	0.0058	0.3591	0.9842
23. Leather products	0.8435	-0.0417	-0.0351	-0.0065	221.3590	165.6882	0.8091	0.1077	0.0806	0.4281
24. Handbags	0.6952	-0.0729	-0.0507	-0.0222	29.3473	80.0009	0.6778	0.0879	0.2395	0.7316
25. Footwear	0.7632	-0.1025	-0.0783	-0.0243	542.1728	581.9708	0.6468	0.1690	0.1814	0.5177
26. Wood products	0.6808	-0.0698	-0.0475	-0.0223	757.2084	2478.0864	0.6412	0.0827	0.2706	0.7660
27. Paper products	0.6818	-0.0535	-0.0365	-0.0170	2244.0989	1084.4208	0.6734	0.2189	0.1058	0.3258
28. Containers of paper	0.7894	-0.0968	-0.0764	-0.0204	733.7654	1283.2617	0.7211	0.1001	0.1750	0.6362
29. Other paper products	0.7600	-0.0754	-0.0573	-0.0181	497.1824	670.7781	0.7168	0.1191	0.1607	0.5743
30. Published and printed products	0.6483	-0.0558	-0.0362	-0.0196	1684.4636	3872.7457	0.5705	0.1291	0.2967	0.6969
31. Recorded media products	0.6184	0.0000	0.0000	0.0000	69.2825	45.7760	0.5474	0.2697	0.1782	0.3978
32. Petroleum products	0.7066	-0.0265	-0.0187	-0.0078	8134.2777	1899.9718	0.6515	0.2805	0.0655	0.1893
33. Basic chemical products	0.5600	-0.0139	-0.0078	-0.0061	1334.9309	1325.1767	0.6799	0.1629	0.1617	0.4982
34. Fertilizers	0.7265	0.0000	0.0000	0.0000	959.8725	434.5553	0.7378	0.1641	0.0743	0.3116
35. Primary plastic products	0.7925	-0.0369	-0.0293	-0.0077	1667.8600	1067.4352	0.7434	0.1547	0.0990	0.3902
36. Pesticides	0.6995	-0.0625	-0.0437	-0.0188	279.6208	223.9886	0.7702	0.1345	0.1077	0.4448
37. Paints	0.7297	-0.0349	-0.0255	-0.0094	430.5328	657.5094	0.7851	0.0836	0.1276	0.6043
38. Pharmaceutical products	0.6486	-0.0094	-0.0061	-0.0033	1604.6934	1438.4289	0.6868	0.1646	0.1476	0.4727
39. Soap products	0.7034	-0.0567	-0.0399	-0.0168	1433.1546	1382.7039	0.7117	0.1463	0.1412	0.4910
40. Other chemical products	0.7357	-0.0340	-0.0250	-0.0090	728.1381	1067.7740	0.7147	0.1139	0.1671	0.5946
41. Rubber tyres	0.6615	-0.0088	-0.0058	-0.0030	350.4352	716.0264	0.6956	0.1033	0.2110	0.6714
42. Other rubber products	0.7383	-0.0720	-0.0531	-0.0188	133.3854	254.7147	0.6855	0.1021	0.1950	0.6563
43. Plastic products	0.6990	-0.1021	-0.0714	-0.0307	583.4278	3290.9159	0.6155	0.0579	0.3267	0.8494

	New shares_intermediate_cost($\sum^N a_{ij}\hat{}P$)	Change_P	$\sum^N a_{ij}\hat{}P$	$\hat{}P - \sum^N a_{ij}\hat{}P$	Rent	Wages	Initial intermediate cost shares	Share_K_cost	Share_L_cost	Share_L_returns_tot_costs [6/(5+6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
44. Glass products	0.6366	-0.0485	-0.0309	-0.0176	283.3314	674.2087	0.5915	0.1207	0.2872	0.7041
45. Ceramicware	0.4659	-0.1018	-0.0474	-0.0544	50.1770	104.0426	0.5849	0.1325	0.2747	0.6746
46. Ceramic products	0.7094	-0.0426	-0.0302	-0.0124	388.7649	660.4384	0.5809	0.1529	0.2597	0.6295
47. Cement	0.3991	0.0000	0.0000	0.0000	1181.8518	308.3131	0.4669	0.4204	0.1097	0.2069
48. Other non-metallic products	0.6630	-0.0443	-0.0294	-0.0149	595.2710	847.7854	0.6709	0.1340	0.1908	0.5875
49. Iron and steel products	0.7100	-0.0389	-0.0276	-0.0113	2146.5004	4889.3080	0.7546	0.0743	0.1692	0.6949
50. Non-ferrous metals	0.8789	-0.0228	-0.0201	-0.0028	5073.4935	1646.7951	0.6153	0.2884	0.0936	0.2450
51. Structural metal products	0.6732	-0.0400	-0.0269	-0.0131	711.7966	2029.9171	0.6278	0.0928	0.2742	0.7464
52. General hardware products	0.6003	-0.0820	-0.0492	-0.0328	259.6576	513.3498	0.5557	0.2502	0.6041	0.6641
53. Other fabricated metal products	0.6955	-0.0457	-0.0318	-0.0139	1516.2853	2404.1154	0.6674	0.1276	0.2022	0.6132
54. Engines	0.7841	-0.0301	-0.0236	-0.0065	48.1831	216.6683	0.7186	0.0504	0.2268	0.8181
55. Pumps	0.5876	-0.0566	-0.0333	-0.0233	31.8318	342.6745	0.6751	0.0272	0.2924	0.9150
56. Gears	0.5760	-0.0862	-0.0496	-0.0365	21.0859	225.4119	0.6730	0.0274	0.2931	0.9145
57. Lifting equipment	0.7434	-0.0354	-0.0263	-0.0091	59.2691	424.5065	0.7407	0.0311	0.2230	0.8775
58. General machinery	0.6336	-0.0238	-0.0151	-0.0087	199.8562	998.2896	0.6674	0.0541	0.2705	0.8332
59. Agricultural machinery	0.7544	-0.0205	-0.0154	-0.0050	38.9772	265.2891	0.6361	0.0457	0.3113	0.8719
60. Machine-tools	0.5865	-0.0165	-0.0097	-0.0068	42.0519	251.7829	0.5561	0.0631	0.3776	0.8569
61. Mining machinery	0.7742	-0.0028	-0.0022	-0.0006	92.7280	864.5770	0.7588	0.0232	0.2166	0.9031
62. Food machinery	0.7655	0.0000	0.0000	0.0000	11.0261	141.0913	0.6712	0.0236	0.3019	0.9275
63. Other special machinery	0.6542	-0.0311	-0.0204	-0.0108	342.1344	1136.6116	0.6149	0.0876	0.2910	0.7686
64. Household appliances	0.7835	-0.1055	-0.0826	-0.0228	110.4535	404.2373	0.7430	0.0546	0.2000	0.7854
65. Office machinery	0.4589	0.0000	0.0000	0.0000	12.9130	32.6167	0.6914	0.0851	0.2149	0.7164
66. Electric motors	0.8038	-0.0432	-0.0347	-0.0085	156.8905	430.6345	0.6814	0.0837	0.2298	0.7330
67. Electricity apparatus	0.7962	-0.0505	-0.0402	-0.0103	361.4485	304.4192	0.6146	0.2072	0.1745	0.4572
68. Wire and cable products	0.8448	-0.1027	-0.0868	-0.0159	612.8356	408.9286	0.7119	0.1694	0.1131	0.4002

	New shares_intermediate_cost($\sum^N a_{ij}\hat{}P$)	Change_P	$\sum^N a_{ij}\hat{}P$	$\hat{}P - \sum^N a_{ij}\hat{}P$	Rent	Wages	Initial intermediate cost shares	Share_K_cost	Share_L_cost	Share_L_returns_tot_costs [6/(5+6)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
69. Accumulators	0.7061	-0.0364	-0.0257	-0.0107	201.7676	208.1963	0.6600	0.1648	0.1700	0.5078
70. Lighting equipment	0.7568	-0.0788	-0.0596	-0.0192	129.1143	139.3338	0.6921	0.1466	0.1582	0.5190
71. Other electrical products	0.7278	-0.0291	-0.0212	-0.0079	539.8401	684.0821	0.6629	0.1481	0.1877	0.5589
72. Radio and television products	0.7434	-0.0228	-0.0169	-0.0058	622.2662	1133.2373	0.6658	0.1183	0.2155	0.6455
73. Optical instruments	0.7008	-0.0027	-0.0019	-0.0008	110.1204	369.5657	0.6862	0.0688	0.2309	0.7704
74. Motor vehicles	0.8461	-0.1129	-0.0955	-0.0174	2477.6247	3449.9336	0.8339	0.0705	0.0981	0.5820
75. Motor vehicles parts	0.7010	-0.0167	-0.0117	-0.0050	1045.1210	2489.5469	0.6568	0.1017	0.2423	0.7043
76. Other transport products	0.7142	-0.0129	-0.0092	-0.0037	294.9752	1150.6260	0.5875	0.0832	0.3246	0.7959
77. Furniture	0.6783	-0.0915	-0.0621	-0.0295	513.0373	1411.0539	0.7129	0.0753	0.2072	0.7334
78. Jewellery	0.8897	-0.0698	-0.0621	-0.0077	160.2414	213.4932	0.8536	0.0619	0.0825	0.5712
79. Other manufacturing	0.6475	-0.0406	-0.0263	-0.0143	246.1150	481.1855	0.6875	0.1044	0.2041	0.6616